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VII. POLARIZED CELL DIFFERENTIATION

B. APICAL DIFFERENTIATIONS

1. *Monopolar patterns*

a) *Fungal exosporulation:* a^2 *Sporangia*

A unique capability of excised segments of sporangiophores of the terrestrial mold *Phycomyces* is to regenerate new sporangiophores with sporangia (Götze, 1918). The excised segments in the sporangiophore preferentially regenerate at the apical end. In addition to this segmental polarity, there is a polarity of the whole sporangiophore. Moreover, the fact that "polarity is not destroyed by acropetal or basipetal centrifugation seems to indicate that the plasma membrane or the cell wall (see also proposal for algal axiation in C.3.a) plays a crucial role in the polarity". Galland and Ootaki (1987) conclude from their comprehensive review that the molecular basis for this polarity is still obscure, and one of the challenging problems in *Phycomyces* differentiation remains to discover what molecules constitute the actual gradient and where are they located?

The tip of the growing zone of the sporangiophores of *Phycomyces* (Bergman *et al.,* 1969) is the site where the gravitropic bending occurs (Sachs, 1879, in Shropshire and Lafay, 1987, see VIII.A.2.c^4).

a^3 *Basidiospores*

Basidia of *Coprinus cinereus* continue differentiation when explanted to water agar and vegetative hyphal tips monopolarly elongate from the four apical sites of the basidium expected to produce sterigmata (Chiu and Moore, 1990).

C. APICO-BASAL DIFFERENTIATIONS

3. a) *Algal eggs (rhizoid-thallic poles)*

In model systems of early embryogenesis of the Fucales, the site of inward current precedes and accurately predicts the site of rhizoid outgrowth (see **I**) and the polar axis can be oriented by external vectors (light, etc.) and two unequal cells result from the first division. Experiments with inhibitors (i.e. the cytochalasins) clearly implicate microfilaments in the process of axis fixation. Moreover, such polarization of two-celled embryo cannot occur in absence of a cell wall, demonstrating that the

presence of this cellular component is an absolute requirement for axis fixation. From these results, Quatrano and Kropf (1989) derive their actual working hypothesis that "axis fixation involves transmembrane bridges at the presumptive rhizoid pole, from the cell wall to the microfilament cytoskeleton".

Using repair shoot cells and rhizoids of the red alga *Griffithsia,* Waaland (1989) tested Jaffe's hypothesis (1968, 1979, see **I**) that transcellular currents are responsible for establishing and maintaining sites of localized secretion and growth. However, in repair shoot cells, the inflowing current continued even when the cell repair hormone rhodomorphin was withdrawn and elongation stopped. Thus, in *Griffithsia* "transcellular currents *per se* do not appear to control localized organelle accumulation and localized growth".

6. *Higher animal cells*

b) *Epithelia (apical-basolateral poles)*

The apical and basolateral, macroscopic domains of polarized epithelial cells are mostly large, morphologically distinct regions of the cell surface which are separated by proteinous barriers.

The rapid diffusion and equilibration of lipophilic NH_3 across cell membranes and the accumulation of NH_4^+ seem to be governed by pH differences between compartments. Kikeri *et al.* (1989) reported that renal tubule cells from the medullary thick ascending limb of Henle have an apical membrane which is not only virtually impermeable to NH_3, but is also highly permeable to NH_4^+. They proposed a model which would explain how this renal epithelium can mediate vectorial movement of NH_4^+ between compartments of equal pH.

A hierarchy of sorting information with multiple sorting signals — apical and basolateral — present in different domains of a given plasma membrane protein has been suggested from the evidence that covalently attached glycosyl-phosphatidylinositol (GPI) acts as a "dominant" apical targeting signal. Polarized epithelial protein sorting might therefore rely on glycolipids (Lisanti and Rodriguez-Boulan, 1990).